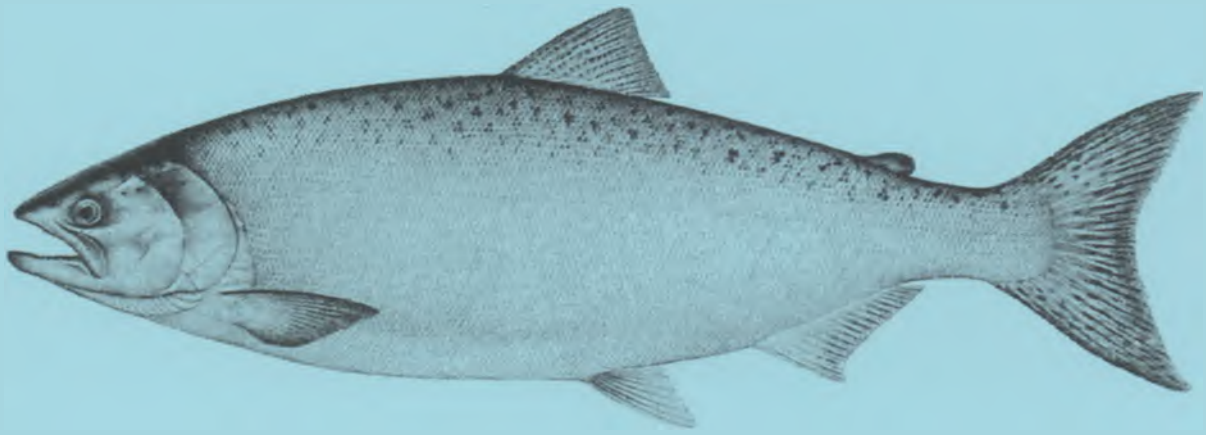
2002
WHITLOCKS BAY SPAWNING STATION
ANNUAL REPORT



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PREFACE

This report discusses the 2002 season at Whitlocks Bay Spawning Station and previous data showing trends during the nineteen years of station operation. The author would like to acknowledge all those who assisted with spawning operations, data collection, and maintenance of the facility. A special thanks to Brian Smith for his dedicated effort that ensured a smooth daily operation of the station. The author would also like to thank Sylvester Schied and Aaron Leingang for assisting with the coded-wire-tag (CWT) reading and station startup and shutdown.

Summary Table

Summary of Spawn-Taking Effort

Whitlocks Bay Spawning Station, 2001

Species	Number returned	Females spawned	Eggs taken	Total cost of spawn	Cost Per 1000 eggs
Chinook salmon	727	311*	1,192,372	$18.259	$15.32

Rainbow trout were not included in this table due to the station not being operated during the spring.
*Does not include green, spent, or bad females spawned

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Introduction

In the early 1970's, the South Dakota Department of Game, Fish and Parks attempted to develop a salmonid sport fishery in Lake Oahe that would utilize the lake's coldwater habitat and diversify the existing fishery. Introductions of kokanee salmon, Bonneville cisco, opossum shrimp, lake herring and lake whitefish were made in hopes of establishing a forage base for a large predator species. These stockings, except for lake trout, were generally unsuccessful. Lake trout were selected because of the possibility that sufficient natural reproduction might occur to maintain a fishery without the need for annual maintenance stocking. However, minimal success was achieved with this species and no natural reproduction of this species was documented. In 1971, 7,500 adult Lake Superior rainbow smelt were stocked into Lake Sakakawea North Dakota and by 1976 smelt had established a self-sustaining population in downstream Lake Oahe. Chinook salmon had also reached Lake Oahe. as early as 1979, from Lake Sakakawea. As a result of the success of Lake Sakakawea rainbow smelt and chinook salmon introductions in North Dakota, the South Dakota Department of Game, Fish and Parks implemented its own chinook salmon program in 1982.

Chinook salmon from the Little Manistee Hatchery in Michigan and a hatchery in Wisconsin had been stocked as smolts into Lake Sakakawea, North Dakota in 1978. The origination of these Great Lakes chinook were from two ocean-run strains from the state of Washington. The first was a Tule' strain chinook which migrated up the Columbia River and spawned in the feeder streams of the Cascade Mountain Range at Spring Creek Hatchery. The second was a Puget Sound strain from Washington's Green River Hatchery. After three years of successful planting of smolts from these West Coast eggs, Michigan became self-sufficient for chinook salmon production. By 1979 chinook salmon stocked in Lake Sakakawea had reached Lake Oahe and by 1981 they were abundant enough that South Dakota Department of Game, Fish and Parks personnel collected 100,000 eggs from 54 female chinook salmon at Whitlocks Bay, Lake Oahe, SD. October 19-22, 1981. Cleghorn Springs Hatchery incubated the eggs and produced 31,280 smolts which were stocked in Whitlocks Bay, April 1982. An additional 260,870 smolts produced from Lake Michigan eggs were also stocked in Lake Oahe. South Dakota has been relatively self-sufficient for salmon eggs since 1984.

The purpose of Whitlocks Bay Spawning Station (WBS) is to collect spawning adults of chinook salmon and rainbow trout so that annual egg-production needs could be met, and a sport fishery in Lake Oahe could me maintained. Artificial propagation of chinook salmon and rainbow trout is necessary because suitable spawning habitat is not available in Lake Oahe's warm and turbid incoming tributaries. The station has also been used to collect brown trout eggs; however, brown trout have not been stocked in Lake Oahe since 1990. Brown trout have not returned to the station since 1994.

Construction of Whitlocks Bay Spawning Station began in 1982 and the station was fully operational in April, 1984. The Whitlocks Bay Spawning Station consists of a fish ladder (artificial stream), four concrete holding ponds (45' X 8' X 4'), a crowding raceway, a 28' X 48' spawning building, and a water supply system (Figure 2). Two submersible pumps, capable of delivering a total of 2,600 gallons of water per minute (depending on lake elevation), are mounted on a skid that is pushed into the reservoir before the pumping season and removed when not in use. Water is pumped from the bay into the station where it gravity flows through raceways and down the fish ladder into the reservoir. The station is located 18 miles west of Gettysburg on Lake Oahe at Whitlocks Bay (Figure 1).

The station is operated from approximately October 7th through October 23rd. Personnel needed at the facility include a manager, a conservation technician and two seasonal employees. Considerable time is spent explaining department fisheries programs and providing guided tours to the public. In the fall. four to six additional people are needed during days of salmon egg collection.

This report discusses the 2002 season at Whitlocks Bay Spawning Station and previous data showing trends during the nineteen years of station operation. For a summary of previous operations, refer to annual reports for the years 1984-2001.

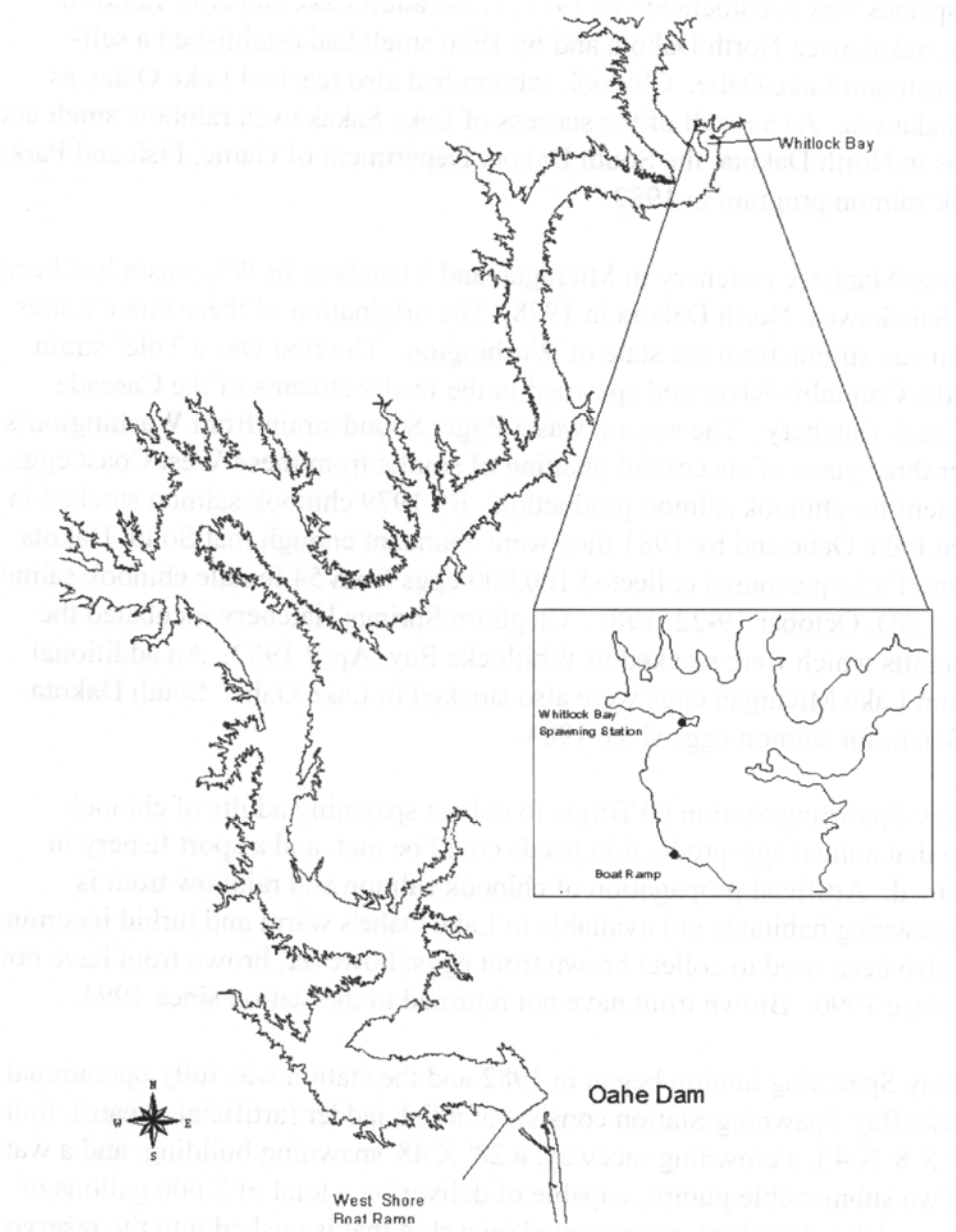

Figure 1. Location of Whitlocks Bay Spawning Station.

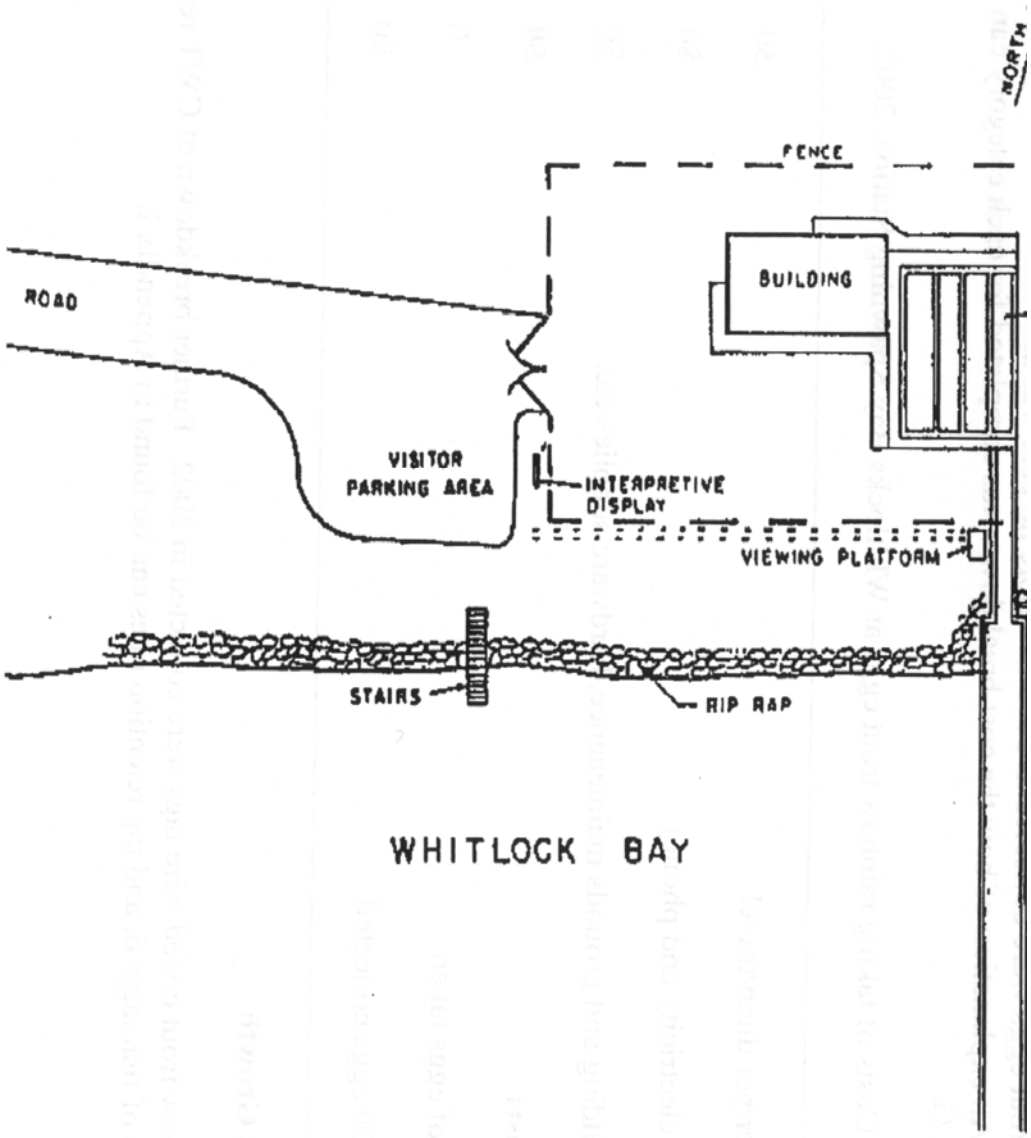

Figure 2. General layout of Whitlocks Bay Spawning Station

Rainbow Trout

Stocking

No rainbow trout were stocked in Lake Oahe in 2002 (Appendix B).

Station Returns and Egg Collection

Whitlocks Bay Spawning Station was not operated this spring due to the overabundance of predators and extreme low abundance of prey fish. This current scenario calls for no stocking of rainbow trout. Past stocking records of rainbow trout for Lake Oahe are presented in Appendices A, B and C.

A summary of past rainbow trout returns and egg collection efforts can be found in Appendix D. No rainbow trout eggs were collected in 2002 therefore no cost was associated with categories listed in Table 1. An explanation of how the cost breakdown was completed for each category can be found in Appendix G.

Table 1. Costs of taking rainbow trout eggs at Whitlocks Bay Spawning Station, 2002.

Manpower/per diem/travel	$0
Utilities (electricity and phone)	$0
Misc.-building and grounds maintenance, hardware supplies etc.	$0
Total Costs	**$0**
Number of eggs taken	0
Cost/1,000 eggs collected	$0

Age and Growth

No rainbow trout coded wire tags were collected in 2002. Further breakdown of CWT returns, numbers of fish tagged, and tag retention rates can be found in Appendix I.

Chinook Salmon

Stocking

No chinook salmon were stocked in Lake Oahe in 2002. For a more detailed summary of current and past chinook salmon stocking, refer to Appendix B, C, F and G.

Station Returns and Egg Collection

On October 6, 2002 the two submersible pumps were turned on, producing a flow of approximately 2,600 gallons of water per minute down the ladder. One pump failed and the remainder of the season the station operated on one pump. Intake water temperatures decreased from 55° to 46°F during the pumping period. One hundred and one chinook salmon ascended the fish ladder the first night (October 6th) the station pumps were left on . Water temperature was 55°F on October 6th. The first salmon usually comes up the ladder the last week of September but due to the late start of the station the first salmon came up during the first week of October. The large number of salmon that came up the first night indicates the salmon run was well underway (Figure 3). Salmon returns were highest from October 15-19 when water temperatures were from 51 to 53°F (Figure 3). Seven hundred and twenty seven chinook salmon ascended the ladder during the fall of 2002. Three salmon egg-take operations yielded approximately 1,192,372 eggs (Table 2). Three hundred and thirty nine females returned via the fish ladder compared to 96, and 86 in 2001 and 2000 respectively. McNenny State Fish Hatchery received 724,380 salmon eggs for incubation and Cleghorn Springs Fish Hatchery received 467,992. For a summary of past chinook salmon returns, egg collection, and percent egg eye up for WBS spawning operations, refer to Appendix E.

Table 2. Number of female chinook salmon spawned and eggs collected, Whitlocks Bay Spawning Station, 2002.

Date	Spawned	Green	Spent	Bad	Eggs Collected
10/9	55	0	-	3	219.622
10/15	134	2		4	504,758
10/23	134	3	-	4	467,992
Total	**323**	**5**	**-**	**11**	**1,192,372**

Age and Growth

Biological data was collected from 165 CWT chinook salmon to provide information on age, growth, and stocking-and-rearing history (Table 3). Approximately 31% (N=25) of the CWT female chinook salmon were age 3 fish. Mean post-spawn length of age 3 female CWT chinook salmon was 695mm (27.4 inches) compared to 626 mm (24.6 inches) in 2001. Approximately 69% (i.e., 56) of the female chinook salmon returned as age 4 fish mean length was 796 mm (31.3 inches) compared to 683 mm (26.9 inches) in 2001. No CWT male chinook salmon returned as age 2 fish or "jacks" because no salmon were stocked in 2000.

Table 3. Age composition. length and weight of 165 coded-wire tagged chinook salmon collected at Whitlocks Bay Spawning Station, fall 2002.

Age	Sex	Brood year	Number	Mean length (mm)	Range	Mean weight* (g)	Range
1	Male	2001	0	----------	----------	----------	----------
2	Male	2000	0				
3	Male	1999	55	725	637-812	3,194	2,196-4,984
	Female		26	695	570-783	2,638*	1,130-4,420
4	Male	1998	27	812	718-891	5,005	3,444-6,147
	Female		57	796	675-905	4,171*	2,957-6,735

*Female weight is post-spawn.
Two of the coded wire tagged salmon were fish stocked in Lake Sakakawea, North Dakota.

A breakdown of the total number, size at stocking and number of CWT salmon stocked in Lake Oahe from 1997 to the present can be found in Appendix F. In addition. South and North Dakota CWT codes and numbers of all tagged fish, from the start of tagging to the present, can be found in Appendices G and H. Detailed breakdowns of treatment groups, number of fish marked, and research purposes behind marking can be found in Appendix I. A complete summarization and analyses of CWT returns from 1987 – 1996 can be found in a report by Lott et al. (1997).

Contribution of North Dakota Salmon

Of the 165 CWT chinook salmon that returned to the WBS in 2002, two were from North Dakota. A percentage was determined using the known number of North Dakota fish tagged from each stock and calculating a percent return from the number (that returned to the spawning station) of North Dakota fish spawned at WBS. In 2002 it was estimated 22 (i.e., approximately 3%) of the 727 salmon that returned to the station were from North Dakota. In 2001 no coded wire tagged salmon returned to WBS. In 2000 it was estimated that 4 (i.e., approximately 1.5%) of the 283 salmon that were captured or that returned to the station were fish from North Dakota. This estimate provides a very rough picture of the contribution of North Dakota salmon to the chinook salmon spawning effort at Whitlock's Bay. No electrofishing was conducted in 2002 for chinook salmon. North Dakota fish were not imprinted on Whitlock Bay therefore it was expected that they would have a higher incidence of straying into bays in an attempt to spawn. Straying North-and-South Dakota chinook salmon were effectively electrofished in backbays in 1999 and 1998. By not electrofishing for salmon in 2000 thru 2002 should mean a large percentage of these straying fish would not be collected to spawn and should help explain the reason for the decreased or nonexistant contribution of North Dakota chinook salmon to Lake Oahe spawn in 2000, 2001 and 2002. The larger percentage of nonimprinted North Dakota salmon in 1998 and 1999 CWT returns could have been related to high water release from Garrison Dam in 1996 and 1997 and to the large number of fish that were straying into bays in an attempt spawn.

Tri-State Chinook Salmon Egg Take and Inter-State Assistance

With few outside sources for disease free chinook salmon eggs and large scale annual fluctuations in the number and quality of salmon eggs collected in Lake Oahe. Lake Sakakawea. and Fort Peck reservoir, tri-state cooperation is a necessity. This cooperation has come in the form of many things (i.e., sharing of CWT machines, research results, manpower, etc.) with the most obvious form of cooperation being the tranfer of chinook salmon eggs or fry/fingerlings among states when needed. A complete summary of South Dakota. North Dakota. and Montana chinook salmon total egg take and inter-state egg, fry and fingerling tranfers can be found in Appendix N. It is hoped that tri-state cooperation will continue and expand as the popularity of salmon fisheries on the prairie mainstem Missouri River reservoirs expands.

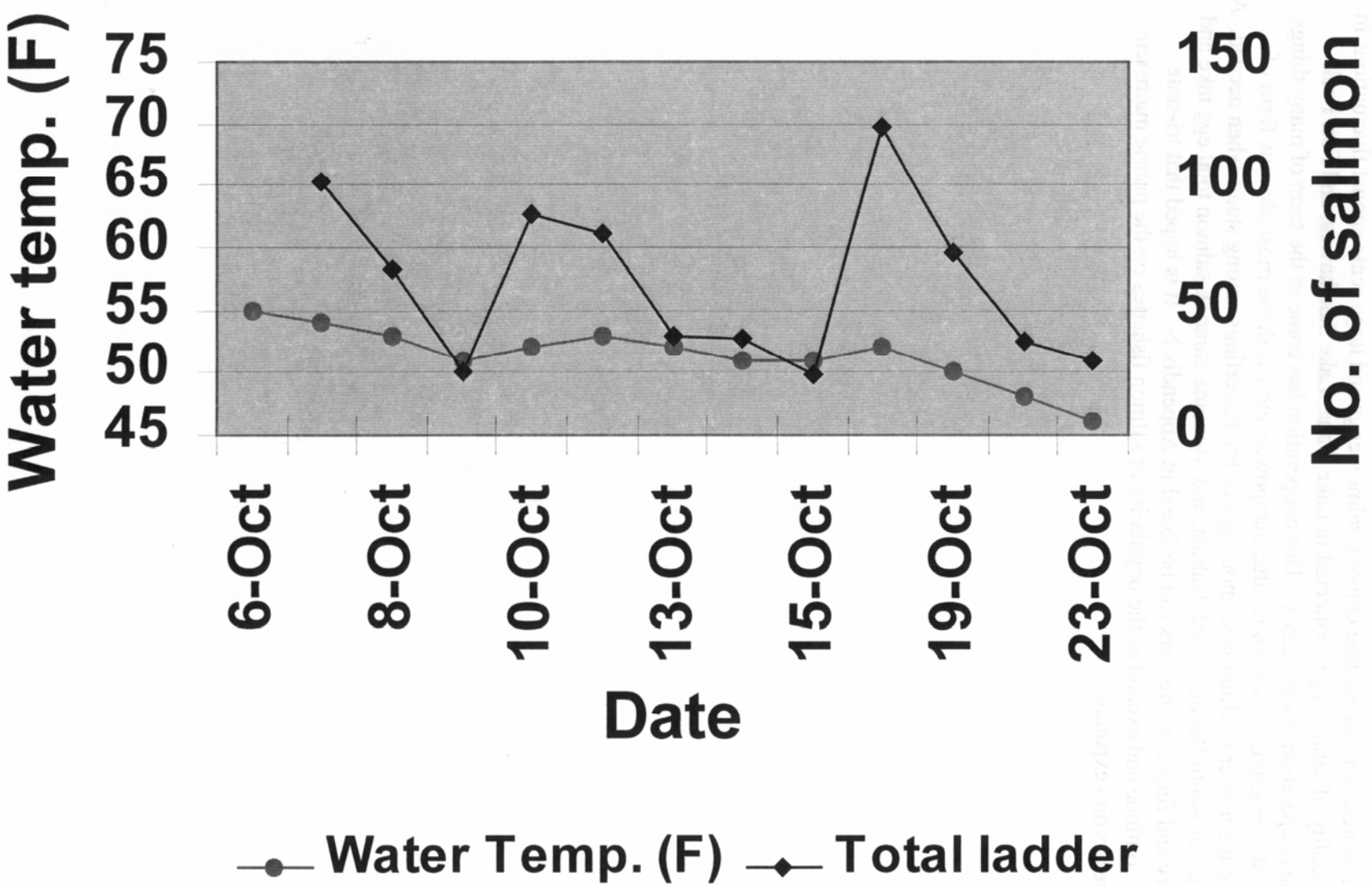

Figure 3. Chinook salmon returns to Whitlocks Bay Spawning Station compared to station intake water temperatures, Lake Oahe, SD, fall 2002.

Past stocking records of chinook salmon for Lake Oahe are presented in Appendix B, C and E and a summary of past salmon returns and egg collection efforts can be found in Appendix E. An explanation of how the cost breakdown was completed for each category can be found in Appendix K.

Table 4. Costs of taking chinook salmon eggs at Whitlocks Bay Spawning Station. 2002.

Manpower/per diem/travel	$4,310.00*
*Utilities	4,483.00
Miscellaneous-pump removal. hardware, etc	9,466.00
Total Costs	**$18,259.00**
Number of eggs taken	1,192,372
Cost/1,000 eggs collected	$ 15.32

*Note previous reports used a value of $20,000 for manpower/per diem/travel costs. An updated value is calculated for this category that more accurately reflects actual manpower/perdiem/travel costs. In 2000, 2001 and 2002 the cost for the salmon eggs was computed from all expenses incurred during the entire year instead of just half year as in previous reports.

Visitation and Tours

The Whitlocks Bay Spawning Station was in operation from October 7 — October 23, 2002. Approximately 200 people visited the facility during that time. Personnel were on duty from 8:00 A.M. to 5:00 P.M. Monday thru Friday to answer questions, give tours and explain fisheries programs. The fish ladder was open for viewing everyday. Many radio, television, and newspaper interviews were provided to the news media. Special tours were given to two organized groups including schools and civic organizations.

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Appendix A. Rainbow trout stocked in Lake Oahe, 1996 – 2002.

Date	Number	Strain	No./lb.	Mark	Treatment	Location
04/15/96	45,298	0	11.5	None	None	WB
04/16/96	18,768	0	8.1	CW	None	WB
04/23/96	20,582	0	10.1	None	None	WB
04/25/96	10,150	0	9.9	None	None	WB
11/04/96	30,327	0	88.2	None	None	WB
11/04/96	20,534	0	56.5	CW	None	WB
04/16/97	80,480	0	11.3	None	None	WB
04/18/97	18,029	0	8.5	CW	None	WB
11/06/97	14,953	0	64.8	CW	None	WB
11/06/97	5,496	0	134.1	None	None	WB
04/13/98	29,162	0	13.65	CW	None	WB
04/20/98	62,157	0	15.38	None	None	WB
11/24/98	18,075	0	17.1	None	None	WB
11/24/98	29,206	0	17.1	CW	None	WB
04/19/99	28,742	0	9.5	None	None	WB
04/20/99	28.131	0	9.11	CW	None	WB
09/09/99	19,885	M	19.56	None	None	WB
09/14/99	17,776	M	16.97	None	None	WB
9/23/99	43,353	M	18.37	None	None	WB
10/27/99	18,669	0	14.43	CW	None	WB
11/03/99	3,331	0	20.46	None	None	WB
11/03/99	9,806	0	15.91	None	None	WB
4/12/00	15.172	0	6.05	CW	Hand Fed	EWB
4/12/00	15,408	0	5.93	CW	Auto Feeder	EWB
4/17/00	2,879	0	7.17	None	None	EWB
7/19/00	67,562	0	47.28	None	None	EWB
2001	0	-	-	-	-	-
2002	0		-			-

CW = coded-wire tagged and adipose fin clipped; AD = adipose fin clipped fish

Appendix B. Numbers of coldwater species stocked in Lake Oahe, 1983 — 2002

Year	Brown Trout	Chinook	Lake Trout	Rainbow Trout	Lake Herring
1983	-----	790.150	7,779	131,395	-----
1984	18.000	784.550	8,560	279.395	470,000
1985	69,000	845,542	4,750	85,635	-----
1986	52.900	811.665	-----	146,229	-----
1987	93,700	1,005.054	-----	50.000	-----
1988	77.167	1.061.535	-----	41.270	200
1989	50.000	217.037	-----	19,150	-----
1990	50.500	66.385	-----	32,370	9,388.500
1991	-----	249A78	-----	18.410	10,995,500
1992	-----	219.000	-----	27.190	11,416,000
1993	-----	275.055	-----	74.707	-----
1994	-----	298,759	-----	81,365	-----
1995	-----	363,787	-----	96,002	-----
1996	-----	418.478	-----	145,659	-----
1997	-----	396.660	-----	118.958	-----
1998	-----	234.101	-----	131,245	-----
1999	-----	104.976	-----	213,506	-----
2000	-----	49,494	-----	101.021	-----
2001	-----	-----	-----	-----	-----
2002	-----	-----	-----	-----	-----

Appendix C. Pounds and kilograms of coldwater species stocked in Lake Oahe, 1982 - 2002.

	Brown trout		Chinook salmon		Lake trout		Rainbow trout		Steelhead trout		Total	
Year	**(lbs.)**	**(kg.)**	**(lbs.)**	**(kg.)**	**(lbs.)**	**(kg.)**	**(lbs.)**	**(kg.)**	**(lbs.)**	**(kg.)**	**(lbs.)**	**(kg.)**
1982	-----	-----	2,169	984	1,373	623	1,988	902	40	18	5,570	2,527
1983	-----	-----	8,889	4,032	1,903	863	1,532	695	-----	-----	12,324	5,590
1984	1,385	632	11,266	5,110	2,094	950	12,541	5,689	-----	-----	27,286	12,377
1985	4,182	1,908	11,882	5,390	1,041	472	1,691	767	430	195	19,226	8,721
1986	5,290	2,414	11,132	5,049	-----	-----	7,901	3,584	6,256	2,838	30,579	13,871
1987	4,462	2,036	15,754	7,146	-----	-----	-----	-----	12,500	5,670	32,716	14,840
1988	5,599	2,555	13,810	6,264	-----	-----	-----	-----	8,351	3,788	27,760	12,592
1989	3,378	1,541	9,299	4,218	-----	-----	-----	-----	2,217	1,006	14,894	6,756
1990	3,389	1,546	2,417	1,096	-----	-----	8,093	3,671	-----	-----	13,899	6,305
1991	-----	-----	8,473	3,843	-----	-----	3,610	1,637	-----	-----	12,083	5,481
1992	-----	-----	5,300	2,404	-----	-----	3,153	1,430	-----	-----	8,453	3,834
1993	-----	-----	7,348	3,333	-----	-----	5,257	2,385	-----	-----	12,605	5,718
1994	-----	-----	8,169	3,705	-----	-----	6,732	3,054	-----	-----	14,901	6,759
1995	-----	-----	9,922	4,501	-----	-----	9,973	4,524	-----	-----	19,895	9,024
1996	-----	-----	10,893	4,941	-----	-----	10,022	4,546	-----	-----	20,915	9,487
1997	-----	-----	5,053	2,292	-----	-----	9,492	4,306	-----	-----	14,545	6,598
1998	-----	-----	9,428	4,277	-----	-----	8,942	4,056	-----	-----	18,370	8,333
1999	-----	-----	7,608	3,451	-----	-----	14,647	6,644	-----	-----	22,255	10,095
2000	-----	-----	6,240	2,830	-----	-----	6,937	3,147	-----	-----	13,177	5,977
2001	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
2002	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total	27,685	12,633	151,204	68,586	6,411	2,908	112,511	51,035	29,794	13,515	341,453	154,883
Average	3,955	1,805	8,894	4,034	1,603	727	7,032	3,190	4,966	2,252	17,971	8,152

Totals and averages were calculated from years when fish were stocked.

Appendix D. Summary of rainbow trout return and egg collection at Whitlocks Bay Spawning Station, 1984 – 2002.

Year	Total rainbows Returned	Number of females spawned	Number of eggs Taken	Average Number of eggs per female	Percent egg eye-up
1984	----	----	----	----	----
1985	----	----	----	----	----
1986	----	----	----	----	----
1987	50	none	----	----	----
1988	57	22	36,915	1,678	----
1989	8	none	----	----	----
1990	7	none	----	----	----
1991	126	39	52,675	1.351	----
1992	296	127	245,660	1,934	----
1993	276	121	319.500	2,640	75
1994	641	170	376,620	2,215	81
1995	340	131	469,085	3.581	71
1996	323	147	411,690	2,801	78
1997	203	95	260,302	2,740	79
1998	111	46	131,245	2,853	60
1999	74	30	70,870	2,362	80
2000	138	47	120,300	2,560	69
2001	0	0	0	0	0
2002	0	0	0	0	0
Total	2650	975	2,494,862	----	----
Average	189	89	226,806	2,429	74

Appendix E. Summary of salmon return and egg collection at Whitlocks Bay Station. 1984-2002.

Year	Total Salmon Returned	Number of females spawned	Number of good eggs	Average Number of Eggs/female	Percent egg eye-up
1984	175	29	81,340	2,800	----
1985	435	119	364,900	3.066	----
1986	484	61	186.746	3.061	----
1987	1,034	187	871.137	4,659	----
1988	1.320	270	667.796	2,473	----
1989	1256[a]	227	418,160	1.842	37
1990	1,107	409	787,708	1.926	40
1991	1,343	193	453,864	2,352	60
1992	690[b]	319	992,630	3,112	40
1993	1,354	449	1,744.100	3,884	53
1994	2,749	408	1,542,180	3,780	44
1995	3.664	527	1,969.162	3.737	48
1996	1,133	355	1.054,841	2,971	74
1997	673[c]	193	558,945	2,896	53
1998	422[d]	211	498,100	2361	48
1999	328[e]	124	316,862	2,555	70
2000	283	74	155,700	2,100	49
2001	468	67	153,264	2,286	31
2002	727	189[f]	724.380[f]	3,833[f]	57[f]
Total	19,317	4.411	8.110,561	32,955	----
Average	1,017	232	426,872	1,735	50

[a]includes 71 females and 121 males from Spring Creek, Sutton Bay and Whitlocks Bay.
[b]includes 307 females from East Shore. Cow/Spring Creek and Cheyenne Creek
[c]includes 124 females and 33 males from Cow/Spring/Okobojo Crks., Sutton Bay, & Cheyenne Creek
[d]includes 131 females from Cow/Spring Creeks, West Shore, Sutton and Whitlocks Bay
[e]includes 76 females from Cow/Spring Creeks and Sutton and Whitlocks Bay
fdoes not include 134 females eggs stripped and fertilized at hatchery (467,992 eggs collected 11% eye-up)

Appendix F. Chinook salmon stocked by number, size and mark in Lake Oahe, 1997 – 2002.

Date	Number	Strain	Hatchery	No./lb.	Mark	Fin clips	Location
04/29/97	10,120	0	BD	50.0	None	None	WB
05/06/97	139,018	0	MN	98.6	None	None	WB
05/19/97	25.155	0	BD	39.0	None	None	WB
05/20/97	19,598	0	BD	39.0	None	None	WB
05/27/97	13,222	0	MN	68.7	None	None	WB
05/27/97	50,428	0	MN	38.9	CW	AD	WB
06/02/97	40,610	0	MN	50.5	None	None	WB
04/27/98	35,070	0	BD	105	None	None	WB
05/27/98	26.075	0	BD	35.0	None	None	WB
06/02/98	28,822	0	MN	34.5	CW	AD	WB
06/02/98	97,292	0	MN	37.7	None	None	WB
09/23/98	18,461	0	MN	9.4	CW	AD	WB
09/30/98	28,381	0	MN	9.6	None	None	WB
06/02/99	15,745	0	MN	40.24	CW	AD	WB
06/02/99	14,519	0	MN	43.13	CW	AD	WB
06/10/99	24,508	0	MN	31.9	None	None	WB
09/29/99	19,371	0	MN	8.2	CW	AD	WB
09/29/99	30,873	0	MN	8.2	None	None	WB
07/19/00	7,458	0	MN	16.46	None	None	WB
09/20/00	15,000	0	MN	8.46	CW	AD	WB
09/26/00	19.494	0	MN	8.58	None	None	WB
09/26/00	15,000	0	MN	8.61	CW	AD	WB
2001	0	-	-	-	-	-	-
2002	0		-	-	-	-	-

CW = coded-wire tagged and adipose fin clipped; AD = adipose fin clipped fish Hatchery codes BD, MN and CS is Blue Dog, McNenny and Cleghorn Springs State Fish Hatcheries

Appendix G. South Dakota chinook salmon coded-wire-tag data 1989 -2003.

Year stocked	Brood year	Description	Number tagged	Number stocked	Tag retention (percent)	Datal	Data2
1990	1989	WBS/Fall Stock (8/lb.)	10,300	----------		17	19
1990	1989	WBS/(53/lb.)	29,019	----------		19	26,27
1991	1989	WBS (29/lb.)	11,990	----------		19	24
1991	1989	OATW (29/lb.)	5,254	----------		19	25
1991	1990	WWB Direct Stock (45/lb.)	19,242	----------		20	28,29,30
1991	1990	WBS Stock	17,850	----------		20	31,32,33,34
1992	1991	WWB (30/lb.)	30,193	----------	89.5%	21	l,2
1992	1991	WWB (runts)	2,623	----------	86.0%	21	3
1993	1992	WWB (34/lb.)	22,959	----------	925%	22	l,2,3
1993	1992	WWB (51/lb.)	18.430	----------	80.0%	22	4,5,6,7
1994	1993	WWB (29.6/lb.)	47,973	210,656	828%	23	l,2,3,4,5,6
1995	1994	WWB (27.9/lb.)	48,469	212,999	98.0%	24	l,2,3,4,5,6
1996	1995	WWB (325/lb.)	46,394	237.217	86.0%	25	1,23,4,5,6
1997	1996	WWB (38.9/lb.)	50,428	243,278	80.5%	26	1,2,3,4,5.6
1998	1997	WWB (34.5/lb.)	28,822	126,144	821%	27	1
1998	1997	WWB (9.41/lb.)	19,315	47,696		27	2
1999	1998	WWB (43.13/lb.)	14,519	54.772	99%	28	1
1999	1998	WWB (40.24/lb.)	15,745	54,772	97.1%	28	2
1999	1998	WWB (8/lb.)	9,686	50,204	98.6%	28	3
1999	1998	WWB (8.12/lb.)	9,685	50,204	98.3%	28	4
2000	1999	WWB (8.61/lb.)	14,850	24,597	99%	29	1
2000	1999	WWB (8.46/lb.)	14,835	24.582	98.9%	29	2
2001	--------	----------	None	None	--------	--------	--------
2002	--------	----------	None	None	--------	--------	--------
2003	2002	WWB (40/lb.)	6,000	6,000			
2003	2002	WWB (40/lb.)	4,000	4,000			
2003	2002	WWB (8/lb.)	4,000	4,000			

Appendix H. North Dakota chinook salmon coded-wire-tag data 1993 -2002.

Year stocked	Brood year	Description	Number tagged	Number stocked	Datal	Data2
1994	1993	Cage reared (28/lb.)	15,000	75,000	28	7
1994	1993	GDNFH (37/lb.)	15,000	204,500	28	1
1994	1993	Cage reared (34/lb.)	15,000	123,000	28	3
1995	1994	Cage reared (36/lb.)	13,500	74,000	24	2
1995	1994	GDNFH (8/lb.)	13.500	23,665	24	6
1995	1994	Cage reared (35/lb.)	13.500	130,000	24	14
1995	1994	GDNFH (33/lb.)	13,500	137,247	30	8
1996	1995	Cage reared (49/lb.)	13,000	120,000	30	4
1996	1995	Cage reared (44/lb.)	13,000	79,000	30	5
1996	1995	GDNFH (39/lb.)	13,000	170,000	30	10
1996	1995	GDNFH (44/lb.)	13,000	120,011	30	12
1997	1996	Cage reared (82/lb.)	52,900	38,059	31	1
1998	1997	Small Cage reared (51/lb.)	18,327	70,000	1	2
1998	1997	Large Cage reared (28/lb.)	18,327	69,500	1	5
1998	1997	GDNFH (41/lb.)	18,327	86,482	1	3
1999	1998	GDNFH (96/lb.)	15,900	131,325	60	1
1999	1998	GDNFH (65/lb.)	15,900	92002	60	2
2000	1999	GDNFH (60/lb.)	15,000	250.000	60	3
2000	1999	GDNFH (90/lb.)	15,000	250,000	60	4
2001	2000	GDNFH (62/lb.)	11,386	255,276	1	72
2001	2000	GDNFH (62/lb.)	602		45	58
2001	2000	GDNFH (62/lb.)	2,012		24	14
2001	2000	GDNFH (106/lb.)	11,248	205,300	1	71
2001	2000	GDNFH (106/lb.)	3,752		30	08
2002	2001	Cage-Rodeo (25/lb.)	14,000	110,007	2	2
2002	2001	Cage-Rodeo (50/lb.)	14,000	98,283	2	1
2002	2001	GDNFH-Rodeo (50/lb.)	14.000	250,554	2	3

Appendix I. South Dakota rainbow trout coded-wire tag data 1991 –2003.

Year stocked	Brood year	Description	Number tagged	Number stocked	Tag retention (percent)	Data1	Data2
1992	1991	WWB (5.68/lb.)	4.135		98%	20	35,36,37
1992	1991	WWB (10.07/lb)	8,115		83%	20	35,36,37
1992	1991	WWB (6.38/lb.)	5,270			20	35,36,37
1992	1991	WWB (122/lb.)	9,670			20	35,36,37
1994	1993	WWB (9.51/lb.), CW	19,440	81,365	93.8%	21	4,5
1995	1994	WWB (9.82/lb.), CN	22,891	100,002	93.9%	23	7,8,9,10
1995	1994	WWB (53.3/lb.), CN	19.655	34,655	93.9%	23	7,8,9,10
1996	1995	WWB (56.5/lb.), CN	18,768	50,861	94.0%	24	7.8
1996	1995	EWB (8.12/lb.), CN	19,655	94,798	85.6%	24	9,10
1997	1996	WWB (64.8/lb.), CN	14,953	20,089	827%	25	7,8,9
1997	1996	WWB (8.54/lb.), CN	18,029	98,509	84.5%	23	6,9,10
1997	1996	WWB (8.54/lb.), CN	“	“	84.5%	17	17,20,21
1997	1996	WWB (8.54/lb.), C	“	“	84.5%	20	33
1998	1997	WWB (13.65/lb.), CW	29,162	91,319	79.4%	26	6.7,8
1999	1998	WWB (9.11/lb), CW	28.131	56,873	89.9%	27	6
1999	1999	WWB (14.43/lb.), CW	18,669	41,654	%	28	8
2000	1999	WWB (5.93/lb.): CW	15,408	15,408	74.1%	28	7
2000	1999	WWB (6.05/lb.); CW	15,172	15,172	625%	28	6
2001	2000	None	-	-	-	-	-
2002	2001	None	-	-	-	-	-
2003	2002	None	-	-	-	-	-

CW = coded-wire tagged and adipose fin clipped; CN = coded-wire tagged no clip

Appendix J. Number of coded-wire-tagged rainbow trout stocked in Lake Oahe, 1987 — 2003. Number stocked is corrected for tag retention.

Date Stocked	Location	Size (number/lb.)	Code	Number Stocked	Treatment	Purpose
4/12/2000	East Whitlock Bay	6.05	28-7	15,172	Hand fed	Determine how feeding practices influence Post-stocking salmonid survival
4/12/2000	East Whitlock Bay	5.93	28-6	15.408	Auto Fed	
2001	----------	----	----	Suspended		Study is suspended due to prey shortage when rainbow trout stocking resumes the study will continue
2002	----------	----	----	Suspended		Study is suspended due to prey shortage when rainbow trout stocking resumes the study will continue
2003	----------	----	----	Suspended		Study is suspended due to prey shortage when rainbow trout stocking resumes the study will continue

Appendix K. Number of coded-wire-tagged chinook salmon stocked in Lake Oahe, 1987 – 2003.
Number stocked is corrected for tag retention

Date Stocked	Location	Size (number/lb.)	Number Stocked	Treatment	Purpose
04/15/87	Whitlocks Bay	70.0	29,602	21 day morpholine imprint at Blue Dog and held 14 days at Whitlocks station.	Evaluate chemical imprinting And stocking size.
04/15/87	Whitlocks Bay	70.0	29,910	Held at Whitlocks station 14 days.	
05/18/87	Whitlocks Bay	32.0	19,876	Held at Whitlocks station 14 days.	
05/18/87	Whitlocks Bay	32.0	20,188	21d morpholine imprint at Blue Dog And held 14 d at Whitlocks Station	
05/12/88	Whitlocks Bay	64.0	64,508	Held at Whitlocks station 10 days.	Evaluate stocking size and Identify Oahe stock.
05/31/88	Whitlocks Bay	30.0	53,815	Held at Whitlocks station 14 days.	
04/12/89	West Shore	3.3	6,235	None	Evaluating yearling stocking size And stocking location. Evaluate Adult return rate of smolts held at Whitlocks station vs. those Stocked directly.
04/13/89	Whitlocks Bay	3.3	6,250	Held at Whitlocks station 4 days.	
05/25/89	Whitlocks Bay	43.8	28,999	Held at Whitlocks station 10 days.	
06/05/89	Whitlocks Bay	34.4	30,164	None- directly stocked into Whitlocks Bay from hatchery	
06/08/90	Whitlocks Bay	53.0	29,019	Held at Whitlocks station 25 days	Evaluate stock size and identify known age fish. Evaluate fall Stock and identify know age fish. Evaluate stock size and identify known age and hatchery source. Evaluate Oahe Tailwater stocking.
11/01/90	Whitlocks Bay	8.0	7,704	Held at Whitlocks station 15 days.	
04/24/91	Whitlocks Bay	2.9	9,232	None — direct stock	
03/08/91	Oahe Tailwaters	3.0	5,254	None	
05/15/91	Whitlocks Bay	45.0	17,850	Held at Whitlocks station 14 days.	Compare adults return rate from Smolts held and stocked from Whitlocks station.
05/16/91	Whitlocks Bay	46.2	19,242	None — direct stock.	

Appendix K. Number of coded-wire-tagged chinook salmon stocked in Lake Oahe, 1987 – 2003.
Number stocked is corrected for tag retention (continued).

Date Stocked	Location	Size (number/lb.)	Code	Number Stocked	Treatment	Purpose
05/27/92	Whitlocks Bay	29.5		30,193	None – direct stock.	Identify known age fish.
05/27/92	Whitlocks Bay	60.3		2,623	None – direct stock	Determine stocking success and Survival of "runts-.
05/25/93	Whitlocks Bay	33.9		22,959	None – direct stock	Identify known age fish. Compare
05/25/93	Whitlocks Bay	50.6		18,430	None – direct stock	Stocking sizes of 34/lb. with 51/lb.
05/23/94	Whitlocks Bay	29.6		47,973	None – direct stock	Identify known age fish.
05/30/95	Whitlocks Bay	27.9		48,469	None – direct stock	Identify known age fish.
05/28/96	Whitlocks Bay	32.5		46,397	None – direct stock	Identify known age fish.
05/27/97	Whitlocks Bay	38.9		50,428	None – direct stock	Identify known age fish.
06/02/98	Whitlocks Bay	34.5		28,822	None – direct stock	Identify known age fish.
09/23/98	Whitlocks Bay	9.4		18,461	None – direct stock	
06/02/99	Whitlocks Bay	40.2	28-2	15,745	Inside circular tank rearing density <10 kg/m3	Determine how rearing density
06/02/99	Whitlocks Bay	43.1	28-l	14,519	Inside circular tank rearing density >20 kg/m3	and water flows influence
09/29/99	Whitlocks Bay	8.0	28-3	9,686	Reared in covered raceway at low flow (200gpm)	post-stocking salmonid survival
09/29/99	Whitlocks Bay	8.l	28-4	9,685	Reared in covered raceway at high flow (>300gpm)	
09/26/00	Whitlocks Bay	8.46	29-2	14,835	Reared in covered raceway at low flow (>100gpm)	Determine how water flows influence
09/26/00	Whitlocks Bay	8.61	29-l	14,850	Reared in covered raceway at high flow (>250gpm)	post-stocking salmonid survival
2001	----------	----	----	Suspended		Study was suspend until FCS stockings
2002	----------	----	----	Suspended		continue due to a prey shortage
2003	Whitlocks Bay	40	*	6,000	Inside circular tank rearing density <10 kg/m3	Replicate 1999
2003	Whitlocks Bay	40	*	4,000	Inside circular tank rearing density >20 kg/m3	Replicate 1999
2003	Whitlocks Bay	8	*	4.000	Growth/survival data	Replicate

* Code designation not determined yet.

Appendix L. Percent recovery of coded-wire tags returned by anglers and recovered at Whitlocks Bay Spawning Station in Lake Oahe, 1988-2002.

Year Stocked	Brood Year	Description	Total Number Stocked	% Tag Retention	Corrected #Tagged fish	Total No. tagged Fish return (fisherman)	Total No. Tagged Fish return (station)	% of tagged FCS returned to				
								Fisherman	Station	Total	Data 1	Data 2
1988	1987	Large (30/lb.)	----------	100%	53.815	183	125	0.34	0.23	0.57	17	1.2,3.4.5,6.7.8
1988	1987	Small (64/1b.)	----------	100%	64,508	90	49	0.14	0.08	0.22	17	9.10.11.12.14.15
1989	1987	Oahe Dam (3.3/lb)	----------	100%	6.235	44	2	0.71	0.03	0.74	17	16
1989	1987	Whitlocks (3.3 lb.)	----------	100%	6.250	28	67	0.45	1.07	1.52	17	18
1989	1988	Whitlock Stock (44/1b.)	----------	92.60%	31,312	66	93	0.21	0.30	0.51	18	22
1989	1988	Direct Stock (34.5/1b.)	----------	100%	30.164	83	146	0.28	0.48	0.76	18	23
1990	1989	WBS/Fall Stock (8/Ib)	----------	74.80%	10,300	93	108	0.90	1.05	1.95	17	19
1990	1989	WBS/(53/1b.)	----------	100%	29.019	114	106	0.39	0.37	0.76	19	26.27
1991	1989	WBS (2.9/1b.)	----------	76.99%	11.990	177	381	1.48	3.18	4.65	19	24
1991	1990	WWB Direct Stock (45/1b.)	----------	100%	19,242	107	106	0.56	0.55	1.11	20	28.29.30
1991	1990	WBS Stock	----------	100%	17,850	82	114	0.46	0.64	1.10	20	3E32.3134
1992	1991	WWB (30/1b.)	----------	89.50%	30,193	186	199	0.62	0.66	1.28	21	1.2
1992	1991	WWB (runts: 60.5/1b.)	----------	86.00%	2.623	2	15	0.08	0.57	0.65	21	1
1993	1992	WWB (34/1b.: Direct stock)	----------	92.50%	22,959	169	220	0.74	0.96	1.69	21	1.2,3
1993	1992	WWB (51/1b.)	----------	80.00%	18.430	104	108	0.56	0.59	1.15	22	4,5,6.7
1994	1993	WWB (29.6/16.)	210.656	82.80%	47,973	269	379	0.56	0.79	1.35	23	1.2.3.4.5.6
1995	1994	WWB (27.9/1b.)	212.999	98.00%	48.469	65	87	0.13	0.18	0.31	24	1.2.3.4.5.6
1996	1995	WWB (32.5/1b.)	237,217	86.00%	46.394	10	18	0.02	0.04	0.06	25	1.2.3.4.5,6
1997	1996	WWB (38.9/1b.)	243,278	80.50%	50,428	23	96	0.05	0.19	0.24	26	1.2.3,4.5.6
1998	1997	WWB (34.5/1b.)	126.144	82.10%	28,822	7	14	0.02	0.05	0.07	27	1
1998	1997	WWB (9.41/1b.)	47.696		19.315	4	28	0.02	0.14	0.17	27	2
1999	1998	WWB (43.13/lb.)	54.772	99,00%	14.519		3	0.00	0.02	0.02	28	1
1999	1998	WWB (40.24/lb)	54.772	97.10%	15.745	2	26	0.01	0.17	0.18	28	2
1999	1998	WWB (8/1b.)	50.204	98.60%	9.686	2	59	0.02	0.61	0.63	28	3
1999	1998	WWB(8.12/lb.)	50,204	98.30%	9,685	2	55	0.02	0.57	0.59	28	4
2000	1999	WWB (8.61/lb.)	24,597	99.00%	14,850	2	58	0.01	0.39	0.40	29	1
2000	1999	WWB (8A6/1b.)	24,582	98.90%	14.835	-	26	0.00	0.18	0.18	29	2
200I	2000	None										
2002	2001	None										

Portions in gray are still being created

Appendix M. Salmon and trout cost breakdown explanation for each category in spring and fall budgets

In the 2002 Whitlocks Report the egg take cost was calculated for the chinook salmon spawn only. All expenses incurred in 2002 were included in the salmon egg costs. Prior to 2002, cost breakdowns for the spring rainbow trout spawn and fall chinook salmon spawn were divided in half. Spring trout spawning costs cover all spawning station operation costs from January 1 to July 15th and salmon spawning costs cover all spawning station operation costs from July 16th to the end of the year.

Costs associated with manpower, per diem and travel to and from the spawning station are factored into the overall spawning costs. A considerably larger portion of this budget is weighted to the fall salmon spawn that requires more people to complete.

Utilities include electricity demand and use charges, and telephone costs. The miscellaneous category includes office and hardware supplies; building and grounds maintenance costs; equipment rental (e.g., CO2 and 0, bottle rental); recreational supplies; vehicle maintenance and repair; propellants/oils/lubricants; rock, sand, gravel etc. Some major repairs associated with both spring and fall spawning operations (i.e., fish ladder repairs, pump repair or replacement) are divided between the two periods. No major maintenance or replacement expenses were incurred in the 2002 season.

Appendix N. Calculation of estimated contribution of North Dakota chinook salmon to the spawn of Lake Oahe, South Dakota 2002.

ID Code	State	Year Stocked	Brood Year	Stocking Size /lb.	ND FCS No. CW I	No. fish Captured	% CWT Returned	Total No. Stocked	Est. No. of ND FCS Fall of 00
60-3	ND	2000	1996	60	15,000	1	0.00667	250,000	17
60-2	ND	1999	1998	65	15,900	1	0.00629.	92,002	6
TOTALS					**30,900**	**2**			**22**

Total FCS Collected Fall 99	Est. No. of ND FCS Fall of 00	Estimated % of ND FCS collected during SD Spawn
727	**22**	**3.09%**

Note: Data used in calculations from Jason Lee, North Dakota Fish and Game Department. CWTTREAT.DBF - Table Records

Appendix O. Summary of South Dakota, North Dakota and Montana chinook salmon total egg take. distribution. or inter-state assistance.

Year	No. of eggs eggs taken **in SD**	No. of eggs eggs taken **in ND**	No. of eggs eggs taken **in MT**	No. of excess Eggs given to **ND from SD**	No. of excess Eggs given to **MT from SD**	No. of excess eggs given to **SD from ND**	No. of excess eggs given to **MT from ND**
1980		90,000					
1981	100,000	400,000					
1982		Unknown					
1983		N/A					250,000
1984	81,340	395,000					
1985	364,900	379,700					
1986	186,746	479,600					177,413
1987	871,137	2,403,000					
1988	667,796	933,234					55,940
1989	418,160	739,350					
1990	787,708	l,574,269					101.210
1991	453,864	654,280					
1992	992,630	l,087,500			112,000		
1993	l,744,100	392,000		677,200			
1994	1,542,180	381,700	0	502,500	50,000		37,000
1995	l,969,162	547,650		849,000	240,000		
1996	l,054,841	l,570,130	390,000	228,000			
1997	558,945	l,126,406				50,000	
1998	498,100	749,116	6,000		49,561		
1999	316,862	3,038,219	141,000		193,000 [a]		250,000
2000	155,700	2,203,638			54,925		344,393
2001	153,264	2,400,322	0		43,150		600,000
2002	l,192,372	2,005,380	64,000		350,800 [b]		
Total	14,109,807	23,550.494	601,000	2,256,700	l,093,436	50,000	1,815,956
Average	705,490	l.121,452	100,167	564,175	136.680	50,000	226,995

[a] Includes 100,000 eggs from collected from Cleghorn Springs Hatchery brood stock

[b] Includes 2000,000 fingerling raised for MT

Appendix P. Length at selected number per pound values for rainbow trout and chinook salmon.

Length at selected number per pound values for rainbow trout

Note: These values come from condition factor averaged from Thousand of hatchery fish measured and weighed and are to be considered with A grain of salt for wild fish.

Condition Factor (C)	Num her per lb.	Individual Weight lb.	Length (inches)
0.0004	2500.00	0.0004	1.0
0.0004	740.74	0.0014	1.5
0.0004	312.50	0.0032	2.0
0.0004	160.00	0.0063	2.5
0.0004	92.59	0.0108	3.0
0.0004	58.31	0.0172	3.5
0.0004	39.06	0.0256	4.0
0.0004	27.43	0.0365	4.5
0.0004	20.00	0.0500	5.0
0.0004	15.03	0.0666	5.5
0.0004	11.57	0.0864	6.0
0.0004	9.10	0.1099	6.5
0.0004	7.29	0.1372	7.0
0.0004	5.93	0.1688	7.5
0.0004	4.88	0.2048	8.0
0.0004	4.07	0.2457	8.5
0.0004	3.43	0.2916	9.0
0.0004	2.92	0.3430	9.5
0.0004	2.50	0.4000	10.0

C is based On English Measurements (Pounds and Inches)

Excel equation to calculate length from a known number/pound.

=10^((LOG(1000/#/**LB**.)-LOG(**Cond Factor*** 1000)/3)

To calculate length in inches enter number/lb here 10

and condition factor (C) here 0.0004

Length in Inches = 6.30

Excel equation to calculate individual fish weight from a known Length

=**Cond. Factor***(**Length**^3)

To calculate number/lb enter length (inches) here 6.30

and condition factor (C) here 0.0004

Weight per fish = 0.1000

Number per pound = 9.9981

Length at selected Number per Pound values for Chinook Salmon

Note: These values come from condition factor averaged from thousand of hatchery fish measured and weighed and are to be considered with a grain of salt for wild fish.

Condition Factor	Number per lb.	Individual weight lb.	Length (inches)
0.0003	3333.33	0.0003	1.0
0.0003	987.65	0.0010	1.5
0.0003	416.67	0.0024	2.0
0.0003	213.33	0.0047	2.5
0.0003	123.46	0.0081	3.0
0.0003	77.75	0.0129	3.5
0.0003	52.08	0.0192	4.0
0.0003	36.58	0.0273	4.5
0.0003	26.67	0.0375	5.0
0.0003	20.04	0.0499	5.5
0.0003	15.43	0.0648	6.0
0.0003	12.14	0.0824	6.5
0.0003	9.72	0.1029	7.0
0.0003	7.90	0.1266	7.5
0.0003	6.51	0.1536	8.0
0.0003	5.43	0.1842	8.5
0.0003	4.57	0.2187	9.0
0.0003	3.89	0.2572	9.5
0.0003	3.33	0.3000	10.0

Guide to selecting Condition Factor (C) For various Fish Species

Condition Factor (C)	Species
0.000150	Muskellune and Tiger Muskie
0.000200	Northern Pike
0.000250	Lake Trout
0.000300	Chinook Salmon. Walleye. Channel Catfish
0.000350	Cutthroat. Coho
0.000400	Rainbow. brook and brown trout
0.000450	Large Mouth bass

Haskell. David G. 1959. Trout growth in hatcheries. New York Fish and Game Journal, Vol. 5. no. 2, pp. 204 - 237.

Appendix Q. Chinook salmon carcass contract results for 2002.

2002 Whitlocks Bay Spawning Station
Salmon Carcass Contract

Date	Number of Salmon Received	Pounds of Fish Received	Bid Price/lb.	Total
Oct. 9, 2002	152	1,160	$0.10	$116.00
Oct. 14, 2002	330	2,297	$0.10	$229.70
Oct. 23 2002	238	2065	$0.10	$206.50
Total:	**720**	**5,522**		**$552.20**

2002 revenue for salmon carcasses paid to the SD GFP

from Steamboat Game and Fish processing **$552.20**

Note additional weight over 7.000 pounds rate changes to 8 cents/pound.